HAF1003(L), HAF1003(S)

Silicon P Channel MOS FET Series
Power Switching

HITACHI

ADE-208-626B (Z)
3rd. Edition
July 2000

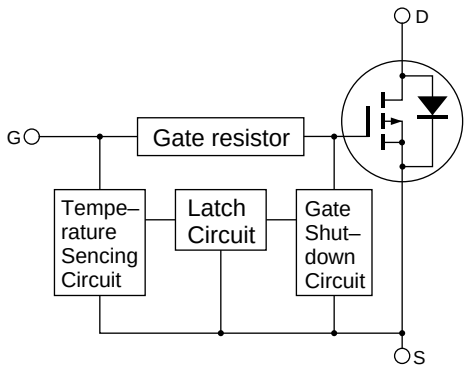
This FET has the over temperature shut–down capability sensing to the junction temperature. This FET has the built–in over temperature shut–down circuit in the gate area. And this circuit operation to shut–down the gate voltage in case of high junction temperature like applying over power consumption, over current etc.

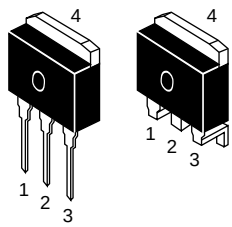
Features

- Logic level operation (–4 to –6 V Gate drive)
- High endurance capability against to the short circuit
- Built–in the over temperature shut–down circuit
- Latch type shut–down operation (Need 0 voltage recovery)

Outline

LDPAK





1. Gate
2. Drain
3. Source
4. Drain

Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	–60	V
Gate to source voltage	V_{GSS}	–16	V
Gate to source voltage	V_{GSS}	2.5	V
Drain current	I_D	–18	A
Drain peak current	$I_{D(pulse)}$ Note1	–36	A
Body-drain diode reverse drain current	I_{DR}	–18	A
Channel dissipation	Pch Note2	50	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Note: 1. PW ≤ 10ms, duty cycle ≤ 1 %
2. Value at Tc = 25°C

Typical Operation Characteristics

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	–3.5	—	—	V	
	V_{IL}	—	—	–1.2	V	
Input current	I_{IH1}	—	—	–100	µA	Vi = –8V, V_{DS} = 0
(Gate non shut down)	I_{IH2}	—	—	–50	µA	Vi = –3.5V, V_{DS} = 0
	I_{IL}	—	—	–1	µA	Vi = –1.2V, V_{DS} = 0
Input current	$I_{IH(sd)1}$	—	–0.8	—	mA	Vi = –8V, V_{DS} = 0
(Gate shut down)	$I_{IH(sd)2}$	—	–0.35	—	mA	Vi = –3.5V, V_{DS} = 0
Shut down temperature	T_{sd}	—	175	—	°C	Channel temperature
Gate operation voltage	Vop	–3.5	—	–12	V	

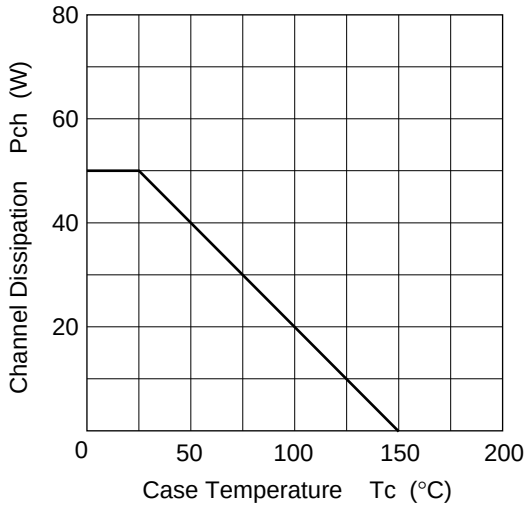
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	–6	—	—	A	V_{GS} = –3.5V, V_{DS} = –2V
Drain current	I_{D2}	—	—	–10	mA	V_{GS} = –1.2V, V_{DS} = –2V
Drain to source breakdown voltage	$V_{(BR)DSS}$	–60	—	—	V	I_D = –10mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	–16	—	—	V	I_G = –300µA, V_{DS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	2.5	—	—	V	I_G = 100µA, V_{DS} = 0
Gate to source leak current	I_{GSS1}	—	—	–100	µA	V_{GS} = –8V, V_{DS} = 0
	I_{GSS2}	—	—	–50	µA	V_{GS} = –3.5V, V_{DS} = 0
	I_{GSS3}	—	—	–1	µA	V_{GS} = –1.2V, V_{DS} = 0
	I_{GSS4}	—	—	100	µA	V_{GS} = 2.4V, V_{DS} = 0
Input current (shut down)	$I_{GS(op)1}$	—	–0.8	—	mA	V_{GS} = –8V, V_{DS} = 0
	$I_{GS(op)2}$	—	–0.35	—	mA	V_{GS} = –3.5V, V_{DS} = 0
Zero gate voltege drain current	I_{DSS}	—	—	–10	µA	V_{DS} = –60 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	–1.1	—	–2.25	V	I_D = –1mA, V_{DS} = –10V
Static drain to source on state resistance	$R_{DS(on)}$	—	80	110	mΩ	I_D = –9A, V_{GS} = –4V [Note3]
Static drain to source on state resistance	$R_{DS(on)}$	—	52	60	mΩ	I_D = –9A,V_{GS} = –10V [Note3]
Forward transfer admittance	$\|y_{fs}\|$	5.3	11	—	S	I_D = –9A, V_{DS} = –10V [Note3]
Output capacitance	Coss	—	700	—	pF	V_{DS} = –10V , V_{GS} = 0 f = 1 MHz
Turn-on delay time	$t_{d(on)}$	—	8.7	—	µs	I_D = –9A, V_{GS} = –5V
Rise time	t_r	—	44.5	—	µs	R_L =3.3Ω
Turn-off delay time	$t_{d(off)}$	—	4	—	µs	
Fall time	t_f	—	4.6	—	µs	
Body–drain diode forward voltage	V_{DF}	—	–0.9	—	V	I_F = –18A, V_{GS} = 0
Body–drain diode reverse recovery time	t_{rr}	—	140	—	ns	I_F = –18A, V_{GS} = 0 diF/ dt =50A/µs
Over load shut down operation time [Note4]	t_{os1}	—	3	—	ms	V_{GS} = –5V, V_{DD} = –16V
	t_{os2}	—	1.5	—	ms	V_{GS} = –5V, V_{DD} = –24V

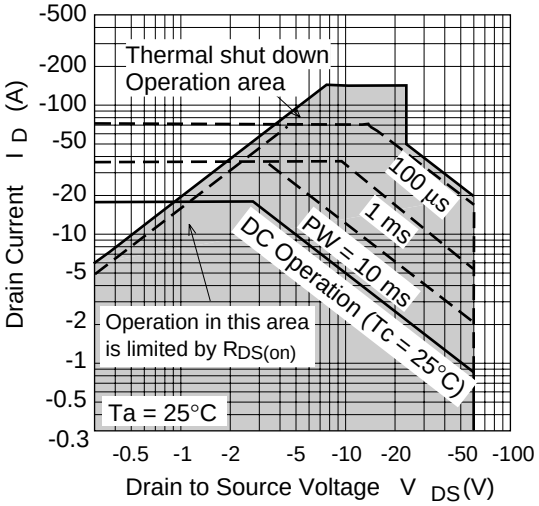
Note: 3. Pulse test

4. Including the junction temperature rise of the over loaded condition.

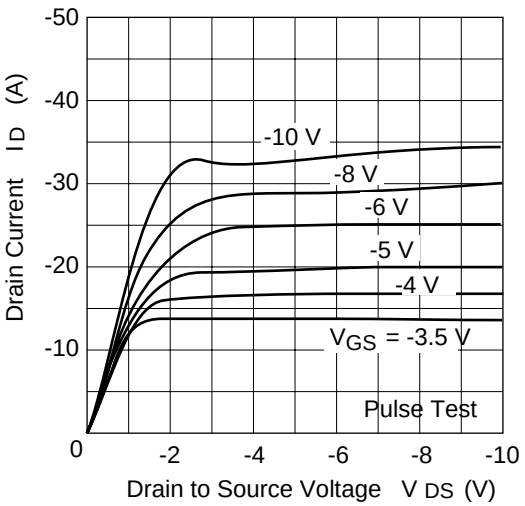
Power vs.Temperature Derating



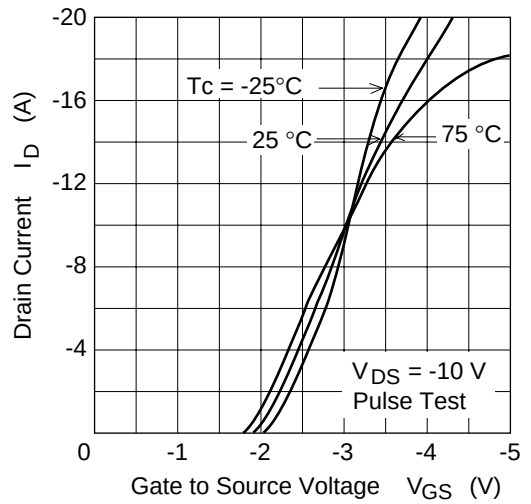
Maximum Safe Operation Area



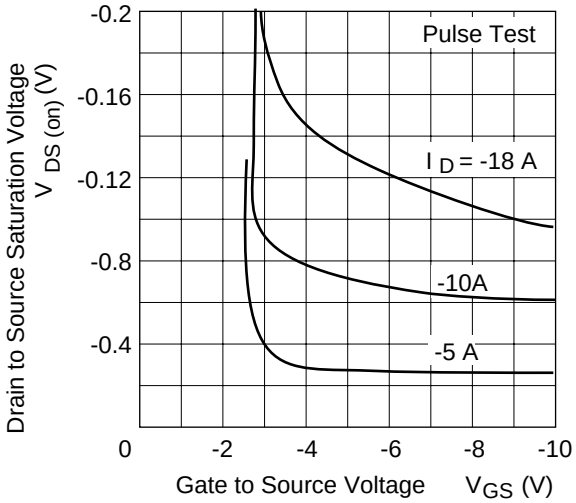
Typical Output Characteristics



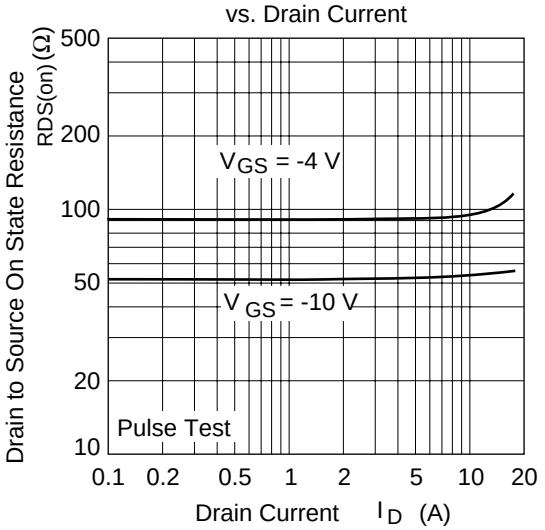
Typical Transfer Characteristics



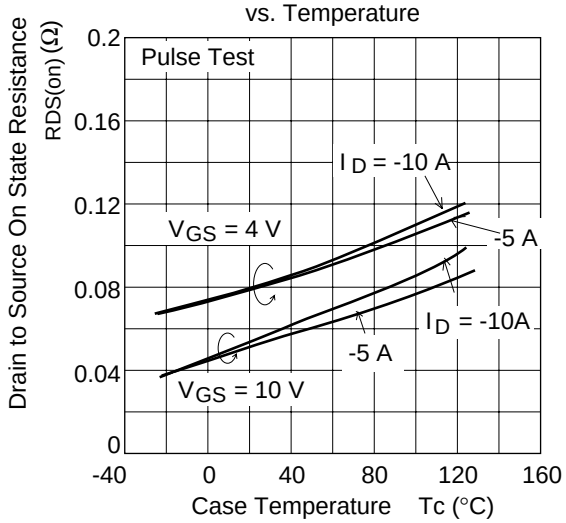
Drain to Source Saturation Voltage vs. Gate to Source Voltage



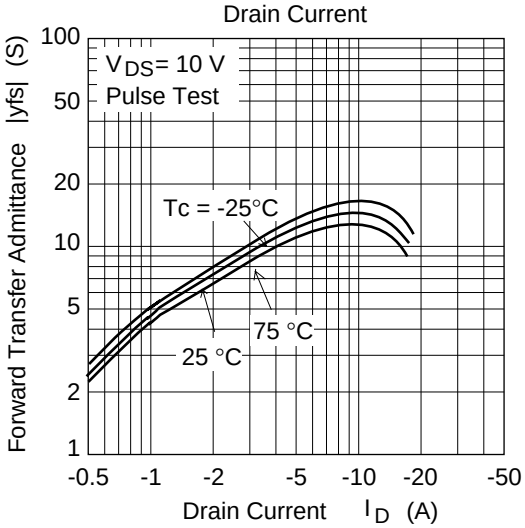
Static Drain to Source State Resistance vs. Drain Current



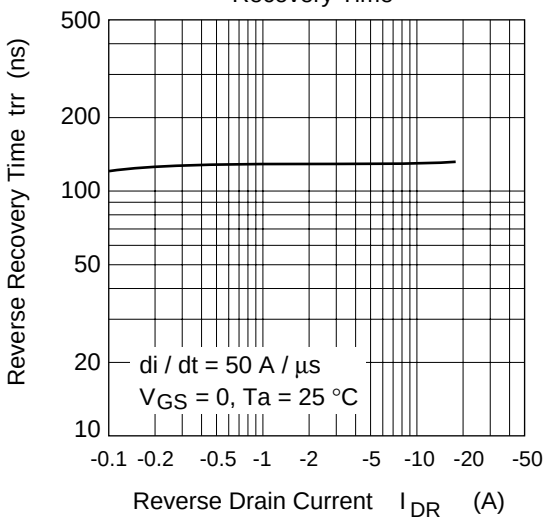
Static Drain to Source on state Resistance vs. Temperature



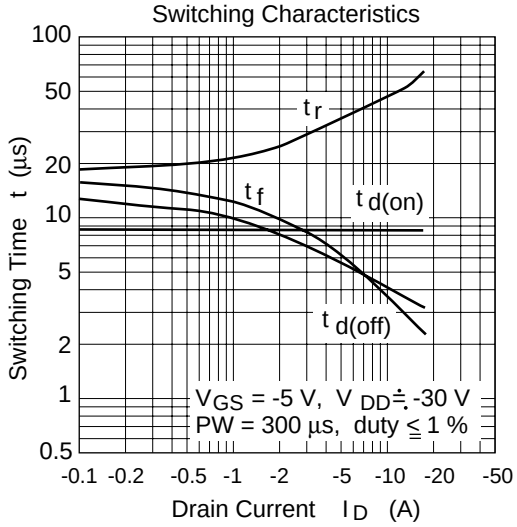
Forward Transfer Admittance vs. Drain Current



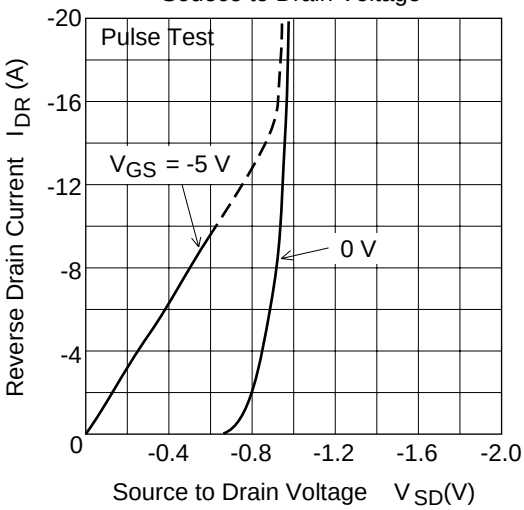
Body to Drain Diode Reverse Recovery Time



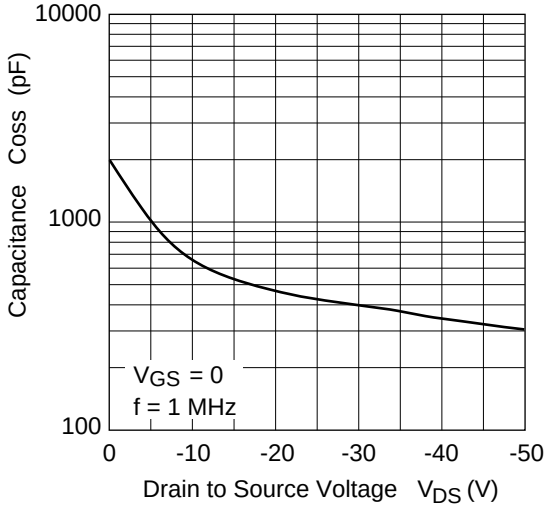
Switching Characteristics



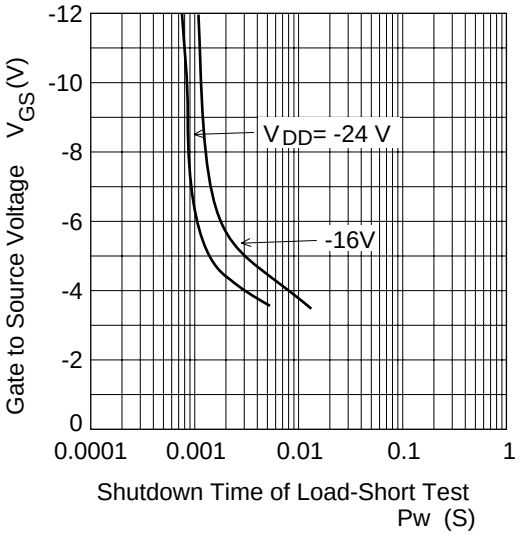
Reverse Drain Current vs. Souece to Drain Voltage



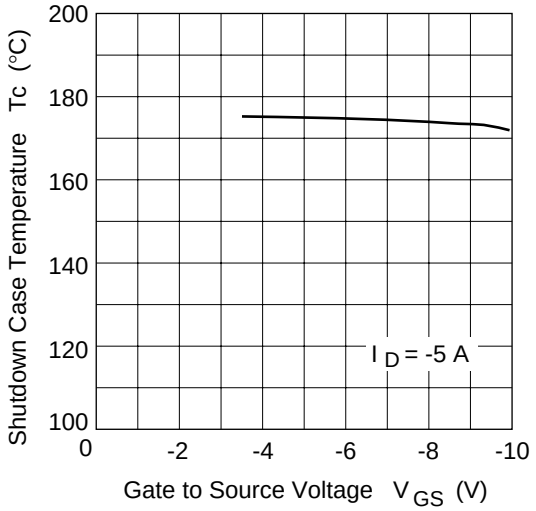
Typical Capacitance vs. Drain to Source Voltage



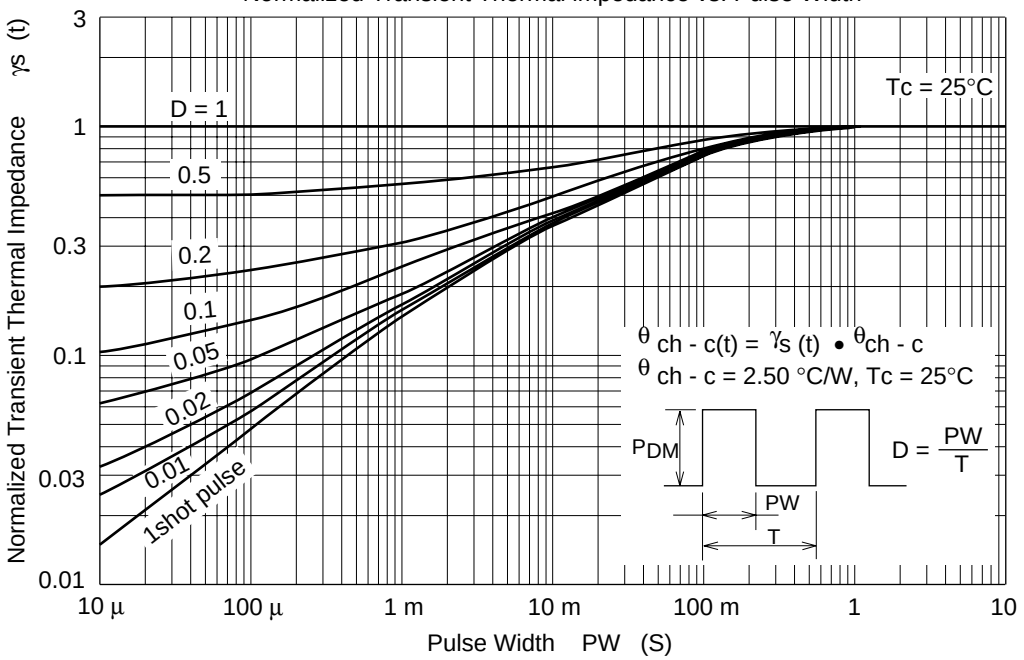
Gate to Source Voltage vs.
Shutdown Time of Load-Short Test



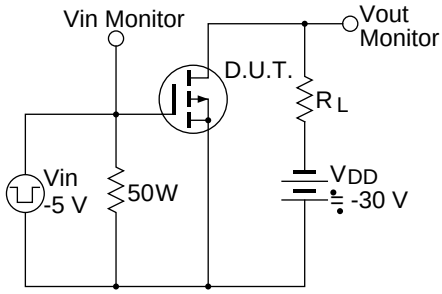
Shutdown Case Temperature vs.
Gate to Source Voltage



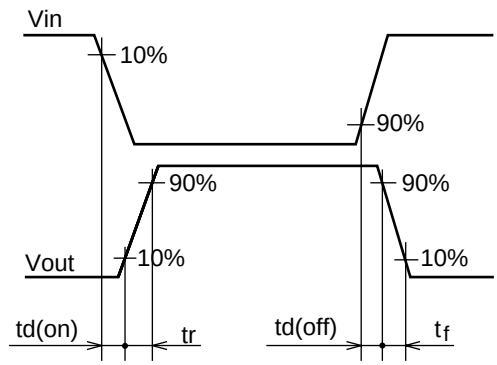
Normalized Transient Thermal impedance vs. Pulse Width



Switching Time Test Circuit



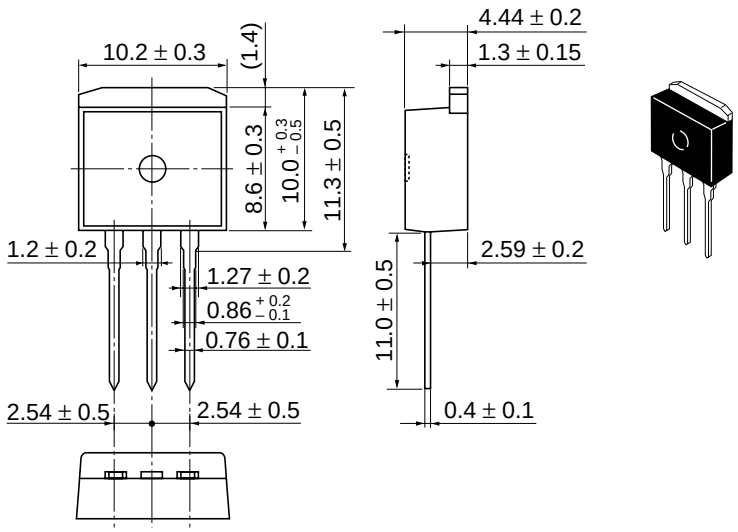
Waveform



Package Dimensions

As of January, 2001

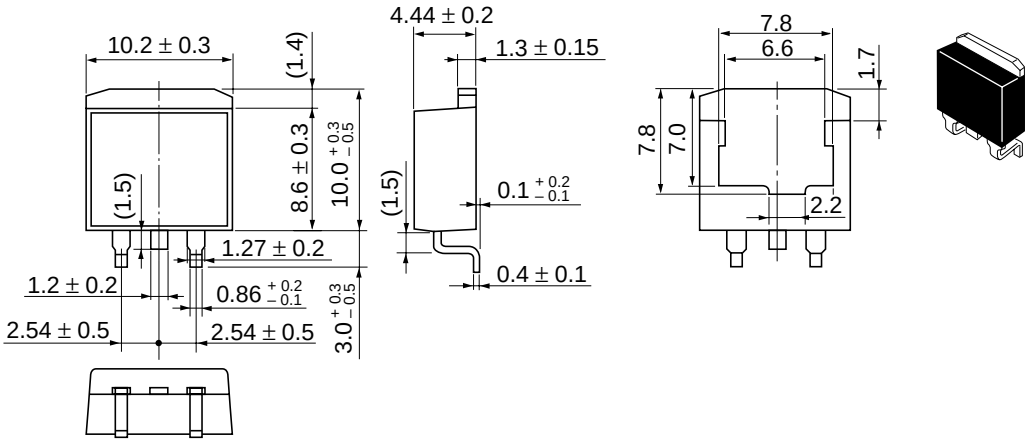
Unit: mm



Hitachi Code	LDPAK (L)
JEDEC	—
EIAJ	—
Mass (reference value)	1.4 g

As of January, 2001

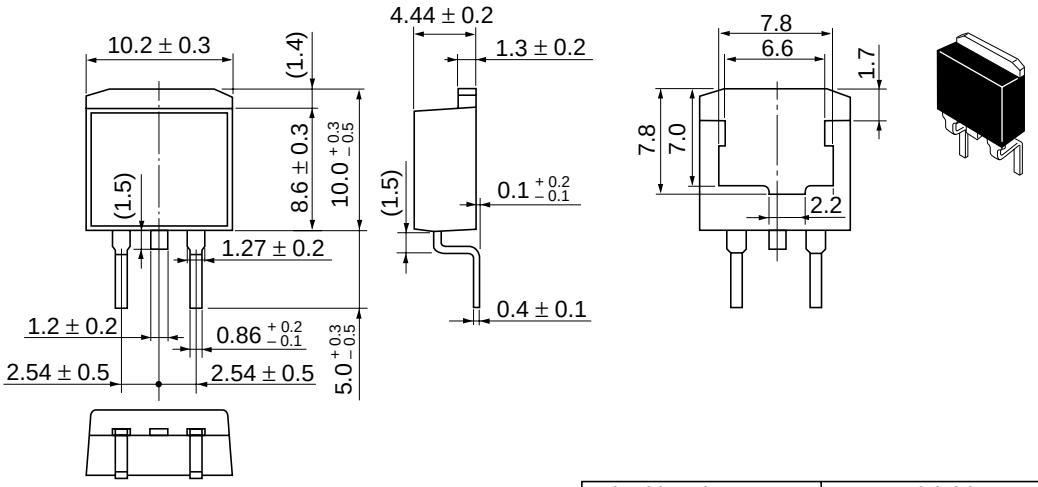
Unit: mm



Hitachi Code	LDPAK (S)-(1)
JEDEC	—
EIAJ	—
Mass (reference value)	1.3 g

As of January, 2001

Unit: mm



Hitachi Code	LDPAK (S)-(2)
JEDEC	—
EIAJ	—
Mass (reference value)	1.35 g

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

HITACHI

Hitachi, Ltd.
Semiconductor & Integrated Circuits.
Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

URL
NorthAmerica : http://semiconductor.hitachi.com/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia : http://sicapac.hitachi-asia.com
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

For further information write to:

Hitachi Semiconductor
(America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic Components Group
Dornacher Straβe 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585160

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00,
Singapore 049318
Tel : <65>-538-6533/538-8577
Fax : <65>-538-6933/538-3877
URL : http://www.hitachi.com.sg

Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road,
Hung-Kuo Building,
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : http://www.hitachi.com.tw

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower,
World Finance Centre,
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon,
Hong Kong
Tel : <852>-(2)-735-9218
Fax : <852>-(2)-730-0281
URL : http://www.hitachi.com.hk

Colophon 2.0